

Preliminary Amendment
National Stage of PCT/JP2004/017698
Attorney Docket No. Q95045

AMENDMENTS TO THE SPECIFICATION

Please replace the last paragraph bridging pages 1 and 2 with the following rewritten paragraph:

[0004] Each of the inventions described in the above Patent Literatures is intended to prolong the service life of the electrode: Japanese Patent Application Laid-Open No. H10-128554 and Japanese Patent Application Laid-Open No. H10-34351 describe inventions intended to prolong the service life by cooling the electrode and Japanese Patent Application Laid-Open No. H8-81723 describes an invention intended to prolong the service life by selecting a proper material of the electrode. However, although all the patent literatures are intended to prolong the service life of the electrode, they are not considered to be particularly effective.

~~Patent literature 1: Japanese Patent Application Laid Open No. H10-128554~~

~~Patent literature 2: Japanese Patent Application Laid Open No. H10-34351~~

~~Patent literature 3: Japanese Patent Application Laid Open No. H8-81723~~

Please replace the second full paragraph no. [0008] on page 3 with the following rewritten paragraph:

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Fig. 1 is a schematic for illustrating an overview of a welding apparatus according to an embodiment a ~~first embodiment~~ of the present invention; and

Fig. 2 is a photograph a cross section of a steel material when a TiC film is formed on the steel material.

Please replace the last paragraph bridging pages 3 and 4 with the following rewritten paragraph:

BEST MODE(S) FOR CARRYING OUT THE INVENTION

[0009] **First Embodiment**

Exemplary embodiments of the present invention will be explained in detail below with reference to the accompanying drawings.

Fig. 1 is a schematic for illustrating a resistance welding electrode and a periphery of the resistance welding electrode according to an embodiment of the present embodiment. A film 2 of metal carbide, for example, titanium carbide (TiC), is formed on a spot welding chip 1 according to the present embodiment, and a nickel-chrome film 3 is formed on the film 2 by plating.

The film 2 of metal carbide is formed by applying voltage between the spot welding chip 1 and a surface treating electrode obtained by heat-treating a powder molding in which a powder including a metal powder that is likely to be carbonized or a metal compound powder as a main component is compression molded, to generate a pulse-like discharge in a working fluid.

In addition, 4 is a metal plate to be bonded by spot welding, 5 is a transformer, and an electrical circuit disposed after the transformer is a well-known one and so is not illustrated.

Please replace the last paragraph bridging pages 4 and 5 with the following rewritten paragraph:

[0011] The resistance welding electrode according to the present embodiment includes the film 2 of TiC which is a hard ceramic formed on the surface and a nickel-chrome

plated layer 3 further formed thereon as described above.

The hard ceramic may be, for example, titanium nitride, TiCN, silicon carbide (SiC), boron carbide (B₄C), chrome carbide (Cr₃C₂, and the like), vanadium carbide (VC), zirconium carbide, niobium carbide, molybdenum carbide, tungsten carbide (WC), and the like, which are other materials. However, the results of TiC were excellent in the experiment conducted.

In addition, the film on the hard ceramic also has a similar effect if it is, for example, a film of metal material including chrome (Cr), nickel (Ni), iron (Fe), tungsten (W), molybdenum (Mo), and the like as a main component, which are other materials. Moreover, the films on the hard ceramic are typically relatively high-melting-point materials each having a melting point of one thousand several hundred degrees Celsius.

The metal film is molded on the topmost surface (the nickel-chrome layer according to the present embodiment) by methods such as plating, physical vapor deposition (PVD), chemical vapor deposition (CVD) ~~PVD, CVD~~, or a method in which a voltage is applied to the region between the molded powder that contains the metal as a main component and the resistance welding electrode to generate a pulse-like discharge in the working fluid. No big differences were observed although the treating methods differed. However, for the hard ceramic layer, which is an intermediate layer, the discharge surface treatment method described below had the biggest effect on prolonging the service life.